

**STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT**

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 45354.1.13 (BD-5108L) F.A. PROJ. BRZ-2903(1)  
COUNTY RANDOLPH  
PROJECT DESCRIPTION BRIDGE NO. 215 ON SR 2903 (OSBORN  
MILL RD.) OVER BACHELOR CREEK

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DATE **JUNE 2011**

## CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

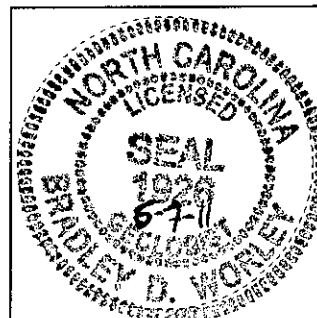
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (ON-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

DRAWN BY: **B.D. WORLEY and D.W. FIELDS**



*Bradley D. Worley*

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**  
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

SOIL DESCRIPTION										GRADATION									
<p>SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRN, SILTY CLN, MOIST WITH INTERMED FINE SAND LAYING, HIGH PLASTIC, A-7-6</i></p>										<p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) DAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p>									
										ANGULARITY OF GRAINS									
<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>										MINERALOGICAL COMPOSITION									
										<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p>									
SOIL LEGEND AND AASHTO CLASSIFICATION										COMPRESSIBILITY									
<p>GENERAL CLASS. GRANULAR MATERIALS (&lt; 35% PASSING #200) SILTY-CLAY MATERIALS (&gt; 35% PASSING #200) ORGANIC MATERIALS</p>										<p>SLIGHTLY COMPRESSIBLE MODERATELY COMPRESSIBLE HIGHLY COMPRESSIBLE</p>									
<p>GROUP CLASS. A-1, A-1-b, A-2, A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5, A-7-6, A-7-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14, A-15, A-16, A-17, A-18, A-19, A-20, A-21, A-22, A-23, A-24, A-25, A-26, A-27, A-28, A-29, A-30, A-31, A-32, A-33, A-34, A-35, A-36, A-37, A-38, A-39, A-40, A-41, A-42, A-43, A-44, A-45, A-46, A-47, A-48, A-49, A-50, A-51, A-52, A-53, A-54, A-55, A-56, A-57, A-58, A-59, A-60, A-61, A-62, A-63, A-64, A-65, A-66, A-67, A-68, A-69, A-70, A-71, A-72, A-73, A-74, A-75, A-76, A-77, A-78, A-79, A-80, A-81, A-82, A-83, A-84, A-85, A-86, A-87, A-88, A-89, A-90, A-91, A-92, A-93, A-94, A-95, A-96, A-97, A-98, A-99, A-100, A-101, A-102, A-103, A-104, A-105, A-106, A-107, A-108, A-109, A-110, A-111, A-112, A-113, A-114, A-115, A-116, A-117, A-118, A-119, A-120, A-121, A-122, A-123, A-124, A-125, A-126, A-127, A-128, A-129, A-130, A-131, A-132, A-133, A-134, A-135, A-136, A-137, A-138, A-139, A-140, A-141, A-142, A-143, A-144, A-145, A-146, A-147, A-148, A-149, A-150, A-151, 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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**  
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p><b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.</p> <p><b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p><b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.</p> <p><b>ARTESIAN</b> - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.</p> <p><b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p><b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p><b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.</p> <p><b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p><b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p><b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p><b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p><b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p><b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL.</p> <p><b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p><b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p><b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p><b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p><b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p><b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p><b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p><b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p><b>ROCK QUALITY DESIGNATION (RQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.</p> <p><b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p><b>SILL</b> - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.</p> <p><b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p><b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS IN OR BPF OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.</p> <p><b>STRATA CORE RECOVERY (SREC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p><b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.</p> <p><b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.		
	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.		
	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.		
	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.		
WEATHERING			
FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.		
VERY SLIGHT (V SLJ)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.		
SLIGHT (SLJ)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.		
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS 'DULL' SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.		
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES 'CLUNK' SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL.</i>		
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF.</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF.</i>		
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.		
ROCK HARDNESS			
VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.		
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.		
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.		
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.		
SOFT	CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.		
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.		
FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.			
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.		
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.		
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.		
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.		
FRAC. MARK: BL-102		NOTES:	
N 675134.9		ARRA borings originally drilled by Summit Consulting under TIP M-0423 in March 2010.	
E 1794375.9		FIAD = Filled in After Drilling	
ELEVATION: 478.96 FT.			



[illegible]



## SHEET 5 OF 19

NC DOT BORE SINGLE 076&000 GEO BRDG0215 ARRA.GPJ NC\_DOT.GDT 6/8/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## CORE BORING REPORT

SHEET 6 OF 19

WBS 45354.1.13				TIP BD-5108L				COUNTY Randolph				GEOLOGIST Stickney, J. K.			
SITE DESCRIPTION Bridge No. 215 on SR 2903 (Osborn Mill Road) over Bachelor Creek												GROUND WTR (ft)			
BORING NO. B1-A				STATION 23+20				OFFSET 8 ft LT				ALIGNMENT -L-		0 HR. N/A	
COLLAR ELEV. 471.1 ft				TOTAL DEPTH 22.5 ft				NORTHING 675,178				EASTING 1,794,432		24 HR. 5.4 FIAD	
DRILL RIG/HAMMER EFF./DATE HFO0072 CME-550 89% 09/02/2009								DRILL METHOD NW Casing W/SPT & Core				HAMMER TYPE Automatic			
DRILLER Smith, M. L.				START DATE 05/23/11				COMP. DATE 05/23/11				SURFACE WATER DEPTH N/A			
CORE SIZE N/A				TOTAL RUN 15.0 ft											
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	ELEV. (ft)	DESCRIPTION AND REMARKS	DEPTH (ft)		
463.6												Begin Coring @ 7.5 ft			
	463.6	7.5	2.0	2:30/1.0	(2.0)	(0.9)		(11.9)	(6.7)		463.6	CRYSTALLINE ROCK	7.5		
	461.6	9.5		2:20/1.0	100%	45%		95%	54%			Very slightly weathered to fresh, medium hard to hard, close to moderately close fractured, weakly foliated, felsic metavolcanic			
460			5.0	2:00/1.0	(4.7)	(3.0)									
				2:10/1.0	94%	60%									
	456.6	14.5		1:55/1.0			RS-1								
			5.0	2:00/1.0	(4.7)	(2.3)									
455				1:51/1.0	94%	46%									
				1:53/1.0											
	451.6	19.5		2:10/1.0							451.1	Moderately weathered, soft to medium hard, close fractured, foliated, felsic	20.0		
450			3.0	2:00/1.0	(3.0)	(0.0)		(2.5)	(0.0)			metavolcanic			
	448.6	22.5		2:15/1.0	100%	0%		100%	0%		448.6	Boring Terminated at Elevation 448.6 ft in Crystalline Rock (felsic metavolcanic)	22.5		

# CORE PHOTOGRAPHS

**B1-A**

BOXES 1 & 2: 7.5 - 22.5 FEET







SHEET 8 OF 19

UNCDOT BORE SINGLE 076&000 GE0 BRDG0215 ARRA.GPJ NC DOT.GDT 6/7/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

SHEET 9 OF 19

WBS 45354.1.13			TIP BD-5108L			COUNTY Randolph			GEOLOGIST Skeen, M.		
SITE DESCRIPTION Bridge No. 215 on SR 2903 (Osborn Mill Road) over Bachelor Creek										GROUND WTR (ft)	
BORING NO. ARRA-1			STATION N/A			OFFSET N/A			ALIGNMENT -L-		
COLLAR ELEV. 478.4 ft			TOTAL DEPTH 17.6 ft			NORTHING 675,077			EASTING 1,794,451		
DRILL RIG/HAMMER EFF./DATE Diedrich D-50						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic		
DRILLER Duggins, W.T.			START DATE 03/16/10			COMP. DATE 03/17/10			SURFACE WATER DEPTH N/A		

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)	
480																
															478.4	GROUND SURFACE
475	475.0	3.4													475.9	ROADWAY EMBANKMENT Red and brown medium stiff fine sandy clayey SILT (A-4)
																2.5
470	470.2	8.2													470.1	WEATHERED ROCK (Tan to gray Metavolcanic Rock)
																8.3
465																
															460.8	CRYSTALLINE ROCK Tan to gray Metavolcanic Rock
																17.6
<p>Boring Terminated at Elevation 460.8 ft in Gray Metavolcanic Rock</p> <p>1) Advanced 2-15/16" tri-cone bit to a depth of 8.3 feet.</p> <p>2) Advanced a NQ core barrel between 8.3 and 17.6 feet</p> <p>2) Set NW casing to 8.0 feet below the existing ground surface.</p> <p>3) Used creek water with bentonite added as drilling fluid.</p>																



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## CORE BORING REPORT

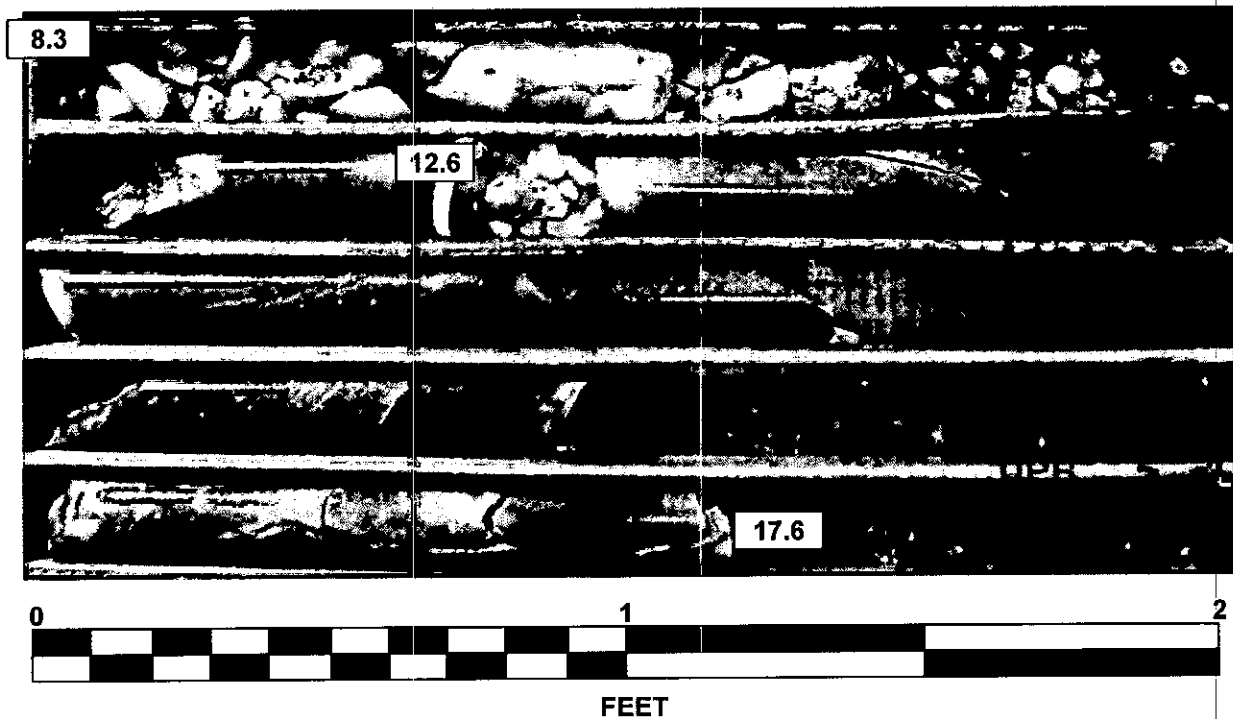
SHEET 10 OF 19

WBS 45354.1.13		TIP BD-5108L		COUNTY Randolph		GEOLOGIST Skeen, M.						
SITE DESCRIPTION Bridge No. 215 on SR 2903 (Osborn Mill Road) over Bachelor Creek							GROUND WTR (ft)					
BORING NO. ARRA-1		STATION N/A		OFFSET N/A		ALIGNMENT -L-						
COLLAR ELEV. 478.4 ft		TOTAL DEPTH 17.6 ft		NORTHING 675,077		EASTING 1,794,451						
DRILL RIG/HAMMER EFF./DATE Diedrich D-50				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic						
DRILLER Duggins, W.T.		START DATE 03/16/10		COMP. DATE 03/17/10		SURFACE WATER DEPTH N/A						
CORE SIZE NQ		TOTAL RUN 9.3 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
477.01	470.1	8.3	4.3	5:58/1.0 4:21/1.0 7:04/1.0 5:21/1.0	(2.7) 63%	(0.7) 16%					Begin Coring @ 8.3 ft	8.3
465	465.8	12.6	5.0	3:12/0.3 6:02/1.0 8:22/1.0 6:13/1.0 7:08/1.0 7:27/1.0	(4.5) 90%	(2.5) 50%					CRYSTALLINE ROCK Tan to gray, fresh, very hard, moderately to closely spaced fractured, Metavolcanic Rock	
	460.8	17.6									Quartz seams between 8.3 to 9.8 and 12.6 to 12.9	
											Boring Terminated at Elevation 460.8 ft in Gray Metavolcanic Rock	17.6
											1) Advanced 2-15/16" tri-cone bit to a depth of 8.3 feet. 2) Advanced a NQ core barrel between 8.3 and 17.6 feet 2) Set NW casing to 8.0 feet below the existing ground surface. 3) Used creek water with bentonite added as drilling fluid.	

# CORE PHOTOGRAPHS

## ARRA-1

BOXES 1 & 2: 8.3 - 17.6 FEET





# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

SHEET 12 OF 19

WBS 45354.1.13			TIP BD-510&L			COUNTY Randolph			GEOLOGIST Skeen, M.							
SITE DESCRIPTION Bridge No. 215 on SR 2903 (Osborn Mill Road) over Bachelor Creek										GROUND WTR (ft)						
BORING NO. ARRA-2			STATION N/A			OFFSET N/A			ALIGNMENT -L-							
COLLAR ELEV. 478.9 ft			TOTAL DEPTH 10.6 ft			NORTHING 675,098			EASTING 1,794,464							
DRILL RIG/HAMMER EFF./DATE Diedrich D-50						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER Duggins, W.T.			START DATE 03/17/10			COMP. DATE 03/17/10			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)	
480																
	478.9														GROUND SURFACE	0.0
475	476.1	2.8	6	4	3										ROADWAY EMBANKMENT Red and brown medium stiff fine sandy clayey SILT (A-4)	
	471.9															7.0
470	471.1	7.8	55	45/0.2											WEATHERED ROCK (Tan to gray Metavolcanic Rock)	
	469.7	9.2	100/0.3													10.6
	468.3	10.6	60/0												Boring Terminated with Tri-cone Refusal at Elevation 468.3 ft on Gray Metavolcanic Rock	
															1) Advanced 2-15/16" tri-cone bit to a depth of 10.6 feet. 2) Set HW casing to 3.5 feet below the existing ground surface. 3) Used creek water with bentonite added as drilling fluid.	



# NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

SHEET 13 OF 19

WBS 45354.1.13			TIP BD-5108L			COUNTY Randolph			GEOLOGIST Skeen, M.					
SITE DESCRIPTION Bridge No. 215 on SR 2903 (Osborn Mill Road) over Bachelor Creek										GROUND WTR (ft)				
BORING NO. ARRA-3			STATION N/A			OFFSET N/A			ALIGNMENT -L-					
COLLAR ELEV. 478.3 ft			TOTAL DEPTH 7.5 ft			NORTHING 675,152			EASTING 1,794,360					
DRILL RIG/HAMMER EFF./DATE Diedrich D-50						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic					
DRILLER Duggins, W.T.			START DATE 03/17/10			COMP. DATE 03/17/10			SURFACE WATER DEPTH N/A					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
480														
														GROUND SURFACE 0.0
														STONE 8.5
475	475.0	3.3												ROADWAY EMBANKMENT 2.5
														Red medium stiff fine sandy silty CLAY (A-7-5)
														WEATHERED ROCK 7.5
														(Tan to gray Metavolcanic Rock)
														Boring Terminated with Tri-cone Refusal at Elevation 470.8 ft
														1) Advanced 2-15/16" tri-cone bit to a depth of 7.5 feet.
														2) Set HW casing to 3.5 feet below the existing ground surface.
														3) Used creek water with bentonite added as drilling fluid.



## SHEET 14 OF 19

NCNDOT BORE SINGLE 076&000 GEO\_BRDG0215\_ARRA.GPJ NC\_DOT.GDT 6/8/11



# NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

SHEET 15 OF 19

WBS 45354.1.13		TIP BD-5108L		COUNTY Randolph		GEOLOGIST Skeen, M.						
SITE DESCRIPTION Bridge No. 215 on SR 2903 (Osborn Mill Road) over Bachelor Creek							GROUND WTR (ft)					
BORING NO. ARRA-4		STATION N/A		OFFSET N/A		ALIGNMENT -L-	0 HR. N/A					
COLLAR ELEV. 478.5 ft		TOTAL DEPTH 5.9 ft		NORTHING 675,165		EASTING 1,794,381	24 HR. 1.0					
DRILL RIG/HAMMER EFF./DATE Diedrich D-50				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic						
DRILLER Duggins, W.T.		START DATE 03/17/10		COMP. DATE 03/17/10		SURFACE WATER DEPTH N/A						
CORE SIZE NQ		TOTAL RUN 5.0 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
477.6											Begin Coring @ 0.9 ft	
475	477.6	0.9	5.0	12:02/1.0 9:31/1.0 14:02/1.0 13:59/1.0 13:50/1.0	(3.5) 70%	(2.3) 46%					CRYSTALLINE ROCK Tan to gray, fresh, very hard, moderately to closely spaced fractured, Metavolcanic Rock	0.9
	472.6	5.9									Boring Terminated at Elevation 472.6 ft in Gray Metavolcanic Rock	5.9
1) Advanced 2-15/16" tri-cone bit to a depth of 0.9 feet. 2) Advanced a NQ core barrel between 0.9 and 5.9 feet 3) Used creek water with bentonite added as drilling fluid.												

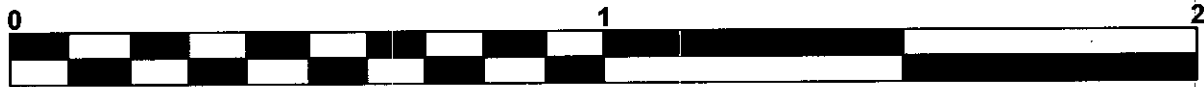
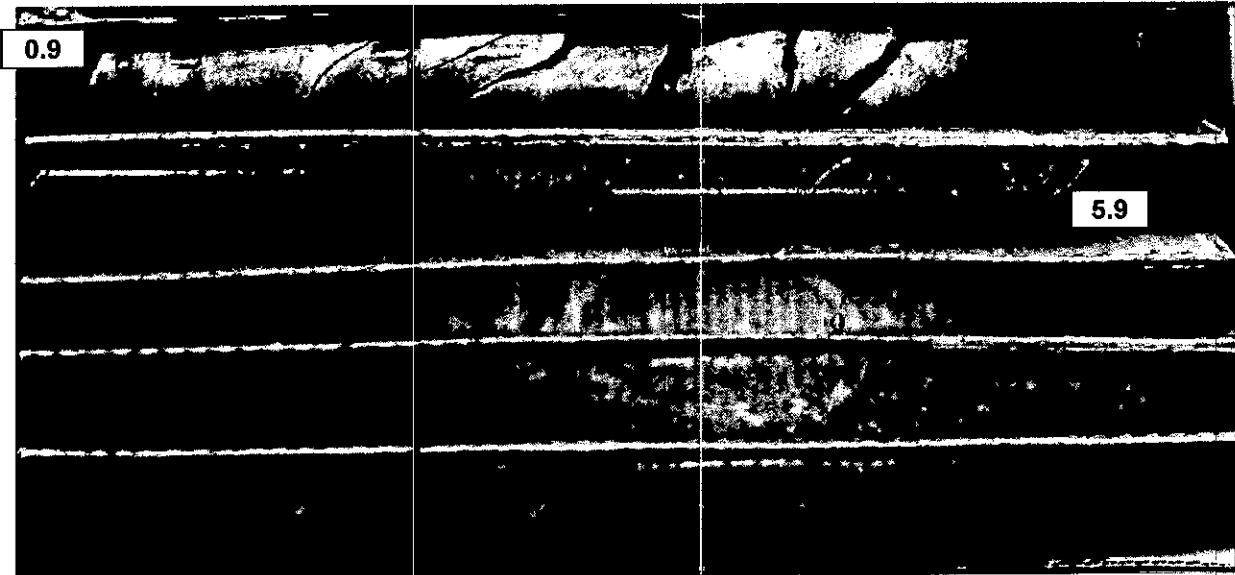
NCDOT CORE SINGLE 078&amp;030 GEO BRDG0215\_ARRA.GPJ NC\_DOT.GDT 6/7/11



# CORE PHOTOGRAPHS

## ARRA-4

BOXES 1: 80.9 - 5.9 FEET



FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT  
FIELD PENETROMETER LOG (ENGLISH)

SHEET 17 OF 19

PROJECT NUMBER	45354.1.13	ID	BD-5108L	CO	Randolph	GEO	C.M. Whalen, Jr.
SITE DESC	Bridge No. 215 on SR 2903 over Bachelor Creek						
BORING NUMBER	SR-1	STA	22+63	OFFSET	CL FT	ALIGNMENT	-L-
ELEVATION	466.5 FT	TOTAL DEPTH	5.5 FT	NORTH	675,138	EAST	1,794,450
DRILL METHOD	Bridge Rod					DRILLER	CMW
START DATE	06/01/11	COMP DATE	06/01/11	SURFACE WTR DEPTH	n/a FT	DEPTH TO ROCK	5.5 FT

DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMPLE NO. & INTERVAL	MOI	ORIGIN	SOIL & ROCK DESCRIPTION <small>(w/ color, density/consistency, texture, plasticity, organics, other)</small>
	0.5 ft	0.5 ft	TOTAL	0	25	50	75	100				
1	0	0	0									Alluv. (0.0-3.0) Alluv., tan-brown, loose, clayey, silty sand (A-2-4)
2	0	0	0									
3	4	4	8									
4	5	10	15									RES (3.0-5.0) Residual, medium dense, silty sand (A-2-4) with gravel
5	14	14	28									
5.5	REF @ 5.5											Bridge rod refusal @ 5.5' (461.00 ft) on crystalline rock (felsic meta-volcanic)

NOTES

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SIGNATURE B. Worley DATE 6-2-11

NOTES

Red-line from orig. handwritten field notes.

DECK TO DATUM DISTANCE

FT



NCDOT GEOTECHNICAL ENGINEERING UNIT  
FIELD PENETROMETER LOG (ENGLISH)

SHEET 18 OF 19

PROJECT NUMBER	45354.1.13	ID	BD-5108L	CO	Randolph	GEO	C.M. Whalen, Jr.
SITE DESC	Bridge No. 215 on SR 2903 over Bachelor Creek						
BORING NUMBER	SR-2	STA	22+83	OFFSET	CL FT	ALIGNMENT	-L-
ELEVATION	473.4 FT	TOTAL DEPTH	5.5 FT	NORTH	6,751,321	EAST	1,794,461
DRILL METHOD	Bridge Rod					DRILLER	CMW
START DATE	06/01/11	COMP DATE	06/01/11	SURFACE WTR DEPTH	n/a FT	DEPTH TO ROCK	5.5 FT

DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMPLE NO. & INTERVAL	MOI	ORIGIN	SOIL & ROCK DESCRIPTION (w/ color, density/consistency, texture, plasticity, organics, other)
	0.5 ft	0.5 ft	TOTAL	0	25	50	75	100				
1	0	0	0								Alluv	(0.0 - 4.0) Alluv., brown, dense, silty sand (A-2-4)
2	0	0	0									
3	0	0	0									
4	4	4	8									
5	20	21									RES	(4.0 - 5.5) Residual, dense, silty sand (A-2-4)
5.5											CR	Bridge Rod refusal @ elev. 467.9' (5.5' depth) on crystalline rock (felsic metavolc.)

NOTES

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SIGNATURE B. Wanky DATE 6-2-11

NOTES

Red-line from original handwritten field notes

DECK TO DATUM DISTANCE FT



# FIELD SCOUR REPORT

WBS: 45354.1.1 TIP: COUNTY: Randolph

DESCRIPTION(1): Bridge No. 215 over Bachelor Creek on SR 2903

## EXISTING BRIDGE

Information from: Field Inspection ☒ Microfilm (reel pos: )  
Other (explain)

Bridge No.: 215 Length: 50' Total Bents: 3 Bents in Channel: 1 Bents in Floodplain: 2  
Foundation Type: Abutment #1: rubble masonry, Abutment #2 and Interior Bent: timber cap, concrete footing

## EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: Undermining at southern end bent.

Interior Bents: Some degradation on streamward side of concrete footing.

Channel Bed: None observed

Channel Bank: None observed

## EXISTING SCOUR PROTECTION

Type(3): Debris from old dismantled dam serves as large rip-rap in stream bed

Extent(4): Upstream and downstream from existing bridge at least 40 to 50 feet.

Effectiveness(5): Appears very effective

Obstructions(6): Partially dismantled dam 100ft. Upstream from existing bridge.

## INSTRUCTIONS

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.



# Rock Test Results

## North Carolina Dept. of Transportation Division of Highways Materials and Tests Physical Testing Laboratory

### Rock Compression

Lab Number: 366723  
Project #: 45354.1.1  
County: Randolph  
Tip ID: B-5108L  
Structure Description: Br #215 over Bachelor ...  
Test Date: 06/01/2011

Sample No.	Diameter in	Area in <sup>2</sup>	Specimen Height in	H/D Ratio	Weight lbf	Unit Weight lbf/m <sup>3</sup>	Ultimate lbf	Ultimate ksi	Ultimate (corrected) ksi	40% Ult. Load lbf	Sec Mod 40% Mpsi
3	1.8690	2.7435	4	2.14	1.0800	168.9	42000	15.3	15.42	18790	1870